

## **Validation of the TROPOMI ozone profile product in the troposphere with TOLNet ground-based lidar observations**

Tropospheric ozone ( $O_3$ ) is a harmful pollutant and near-surface concentrations of this chemical constituent have detrimental impacts on human- and environmental-health. The monitoring of air quality is typically conducted using ground-based in situ measurement networks. However, in recent years, observations of tropospheric  $O_3$  and precursor gases (e.g., nitrogen dioxide ( $NO_2$ ), and formaldehyde ( $HCHO$ )) have been made from space-borne platforms which have led to the better understanding of the tropospheric  $O_3$  budget. The most recent satellite-derived  $O_3$  profile product is provided from the TROPospheric Monitoring Instrument (TROPOMI) onboard the Sentinel-5 Precursor (S5P) satellite which was launched in October 2017. The advantage of TROPOMI  $O_3$  profile data is the unprecedented spatial resolution of  $28.8 \times 5.6 \text{ km}^2$ . To-date, minimal validation of the TROPOMI  $O_3$  profile data focusing on the troposphere has been conducted and published.

The primary objective of this work is to validate the TROPOMI  $O_3$  profile retrieval derived using the Tikhonov regularised Ozone Profile retrieval with SCIATRAN (TOPAS) approach with a focus on the troposphere. The NASA/NOAA Tropospheric Ozone Lidar Network (TOLNet) is the primary data source used here for this  $O_3$  profile validation/evaluation. From a TROPOMI  $O_3$  profile validation perspective, the TOLNet tropospheric lidar product is a desirable validation data set as the observations: 1) have higher vertical resolution compared to TROPOMI retrievals in the troposphere, 2) are high accuracy observations, and 3) do not require a priori information. Statistical analysis of the TROPOMI L2  $O_3$  profile product will be achieved in a way that quantifies the spatiotemporal accuracy/biases and precision using tropospheric lidar data from six different locations in North America. The six TOLNet systems have compiled a TROPOMI validation data set which consists of hundreds of hours of correlative observations made during S5P overpass times (within  $\pm 30$  minutes of the overpass) between 2018-2019. TOLNet will be applied to validate the accuracy in which TROPOMI retrieves the vertical structure of  $O_3$  (i.e., focusing on different vertical levels) in the troposphere during multiple seasons and locations in North America.